

We claim:

1. A method for identifying a faulty measurement among a plurality of measurements that are used to determine a state of a discrete-time controlled process:
 - computing a correlation value associated with each of the plurality of measurements; and
 - selecting a measurement among the plurality of measurements as the faulty measurement based on the correlation values.
2. The method of claim 1 wherein the correlation value associated with each one of the plurality of measurements represents a correlation between residuals of the plurality of measurements and residuals corresponding to a change in the one of the plurality of measurements while the rest of the plurality of measurements are unchanged.
3. The method of claim 1 wherein computing the correlation value associated with each one of the plurality of measurements comprises:
 - computing a residual sensitivity matrix;
 - computing residuals corresponding to the plurality of measurements; and
 - computing a correlation coefficient associated with the one of the plurality of measurements based on the residuals of the plurality of measurements and the residual sensitivity matrix.
4. The method of claim 3 wherein computing the residuals corresponding to the plurality of measurements comprises:
 - obtaining a least-squares solution of the state of the discrete-time controlled process;
 - computing expected values of the plurality of measurements based on the least-square solution; and
 - computing differences between the plurality of measurements and the expected values of the plurality of measurements.
5. The method of claim 3 wherein the residuals corresponding to the plurality of measurements are computed using the residual sensitivity matrix.

6. The method of claim 1 wherein selecting a measurement among the plurality of measurements as the faulty measurement comprises:
 - identifying a highest correlation value; and
 - selecting the measurement associated with the highest correlation value as the faulty measurement.
7. The method of claim 6, wherein selecting the measurement associated with the highest correlation value as the faulty measurement comprises:
 - identifying a second highest correlation value; and
 - selecting the measurement associated with the highest correlation value as the faulty measurement when the difference between the highest correlation value and the second highest correlation value exceeds a predetermined threshold value.
8. The method of claim 6 wherein selecting the measurement associated with the highest correlation value as the faulty measurement comprises:
 - determining that the highest correlation value exceeds a first predetermined threshold value;
 - identifying a second highest correlation value; and
 - determining that the second highest correlation value is smaller the first predetermined threshold value and the difference between the first predetermined threshold value and the second highest correlation value exceeds a second predetermine threshold value.
9. The method of claim 1 wherein the state of the discrete-time controlled process includes corrections to a position and a clock bias of a GPS receiver and the plurality of measurements are GPS range measurements obtained by the GPS receiver with respect to a plurality of satellites, each of the plurality of measurements corresponding to one of the plurality of satellites.
10. The method of claim 9 wherein the number of the plurality of satellites is greater than 5.
11. The method of claim 1, further comprising:
 - determining a size of an error in the faulty measurement.

12. The method of claim 11 wherein determining the size of the error in the faulty measurement comprises:

dividing a root mean square residual of the plurality of measurements by a root mean square residual corresponding to a unit change in the one of the plurality of measurements while the rest of the plurality of measurements are unchanged.

13. The method of claim 11 wherein determining the size of the error in the faulty measurement comprises:

dividing a root mean square residual of the plurality of measurements by the square root of a diagonal element corresponding to the faulty measurement in a residual sensitivity matrix.

14. A method for detecting and identifying a faulty measurement among a plurality of GPS measurements obtained by a GPS receiver with respect to a plurality of satellites, comprising:

determining whether the plurality of GPS measurements include a faulty measurement; and

in response to a determination that the plurality of GPS measurements include a faulty measurement, identifying a satellite contributing the faulty measurement by:

computing a correlation value associated with each of the plurality of satellites; and

selecting a satellite among the plurality of satellites as the satellite contributing the faulty measurement based on the correlation values.

15. The method of claim 14 wherein determining whether the GPS measurements include a faulty measurement comprises:

computing a test statistic using post-fix residuals corresponding to the plurality of GPS measurements; and

determining whether the test statistic exceeds a fault threshold.

16. The method of claim 15 wherein the fault threshold is a function of a navigation mode used by the GPS receiver.

17. The method of claim 15, further comprising:

determining a size of an error in the faulty GPS measurement.

18. The method of claim 17, further comprising:
verifying that the satellite contributing to the faulty measurement has been correctly identified.
19. The method of claim 18 wherein verifying that the satellite contributing to the faulty measurement has been correctly identified comprises:
adjusting the post-fix residuals based on the size of the error in the faulty GPS measurement;
computing the test statistic using the adjusted post-fix residuals; and
verifying that the test statistic does not exceed the fault threshold.
20. The method of claim 14 wherein computing the correlation value associated with a satellite comprises:
computing a residual sensitivity matrix;
computing residuals corresponding to the plurality of GPS measurements; and
computing a correlation coefficient associated with the satellite based on the residuals and the residual sensitivity matrix.
21. The method of claim 14 wherein selecting a satellite among the plurality of satellites as the satellite contributing the faulty measurement comprises:
identifying a highest correlation value; and
selecting the satellite associated with the highest correlation value as the satellite contributing the faulty measurement.
22. A computer readable medium comprising computer executable program instructions that when executed cause a digital processing system to perform a method for identifying a faulty measurement among a plurality of measurements for determining a state of a discrete-time controlled process, the method comprising:
computing a plurality of correlation values, each correlation value associated with one of the plurality of measurements; and
selecting the measurement associated with a highest correlation value among the plurality of correlation values as the faulty measurement.
23. The computer readable medium of claim 22 wherein the method further comprises:
determining a size of an error in the faulty measurement.